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Technical Memorandum

DATE: October 9, 2008

TO: Savary Shores Improvement District

FROM: Irfan Gehlen, P.Eng.

RE: **SAVARY SHORES IMPROVEMENT DISTRICT**
Water System Assessment
Our File 2539.001

As described in our proposal dated March 5, 2008, we are pleased to provide you with this technical memorandum which contains a summary of our findings during our assessment of the Savary Shores Improvement District (SSID) water system. The assessment of the water system includes discussion on conformance with drinking water regulations and recommendations for water system improvements.

Drinking Water Regulations

Small water systems like the SSID are regulated under the *B.C. Drinking Water Protection Act*. The *Act* requires that small water systems are operated in compliance with the requirements of the *Act* and any conditions set by the Drinking Water Officer. As larger water systems become increasingly compliant with regulations, more resources are available and allocated to improve small water system compliance within the province.

Review of Existing Information

Based upon the information provided, three previous studies relevant to this one were completed on Savary Island in the last 15 years. These include a water survey conducted in 1993, a preliminary hydrogeological report completed in 1996 and a groundwater contamination report in 1999. These studies by others were reviewed by KWL and used as background knowledge for this assessment.

Data for comprehensive water quality samples taken between 2003 and 2007 were provided by the SSID for use with this assessment and are summarized in the enclosed table. The water characteristics met the Guidelines for Canadian Drinking Water Quality (GCDWQ) requirements for all parameters. Microbiological monitoring results were retrieved from the Vancouver Coastal Health website. In the last three years, 9 of 137 samples have tested positive for coliforms. In all cases, the positive tests were for total coliforms and not for fecal coliforms or *E. coli*. Fecal coliforms have not been detected in SSID water since 2003, when a boil-water advisory was in place. The 2003 occurrence seems to have been an anomaly and may be attributed to contamination during sample collection.

Site Visit

A site visit took place on May 20, 2008 with members of KWL, SSID and Vancouver Coastal Health (VCH). In attendance were Irfan Gehlen (KWL), Laura Weston (KWL), Dale Gregory (SSID trustee), Bryan Miles (SSID trustee), Bill Taylor (SSID Trustee Rep), Eric Ferreira (SSID System Operator) and Dan Glover (VCH Drinking Water Officer). The site visit included stops at the well site, the two reservoirs and several locations within the distribution system.

The water system is supplied by one well located on Lot No. 129. The groundwater is pumped directly to the upper, 10,000 Imperial gallon reservoir tank and then gravity fed to the lower 40,000 Imperial gallon tank for supply to the distribution system. The upper 10,000 Imperial gallon tank is the main supply source for the upper section of the distribution system and the lower 40,000 Imperial gallon tank supplies the lower distribution system. During the low demand winter months, the entire system can be supplied through the upper tank if desired. The lower, 40,000 Igal reservoir tank is brought online during the high demand summer months. There is no water treatment or disinfection as the groundwater is reported to not be under the direct influence of surface water.

Source Water Protection

The SSID well is sourced by the Main Aquifer that runs the entire length of the island and is confined below a low-permeability layer. The Main Aquifer is eventually recharged by the three other aquifers on the island which are unconfined: Indian Point Aquifer, West Perched Aquifer and Keefer Bay Aquifer. The unconfined aquifers are vulnerable to microbiological contamination and would therefore be considered under the influence of surface water.

There is a concern of salt water intrusion to the well water due to the increasing water demands on the aquifer and the hydraulic connection between the Main Aquifer and the ocean. The ocean's tidal effect causes fluctuations in the aquifer water level. Regular measurements of the well water level would provide correlative data between aquifer water level and the tides.

A preliminary hydrogeological study completed in 1996 suggests that the capacity of the SSID system could likely be augmented to at least 62 IGPM (over double the current pumping rate of 29 IGPM), without causing salt water intrusion. The 1996 report estimates that SSID water use is between 0.5 and 1 percent of the recharge capacity of the aquifer. However, for greater certainty, a well head study including a thorough hydrogeological investigation of the main aquifer would have to be completed. This would provide the community with information regarding the water usage and zone of influence around the wellhead. The delineation of the zone of influence will determine if any potential contamination sources are located within the zone. It should be noted that a wellhead study was recommended by Vancouver Coastal Health during their 2006 routine inspection.

The loss of the use of the ground water source is the greatest potential risk to the SSID. Given that there are no viable surface water sources on the island, monitoring wells should be installed at various locations to understand and establish the long term water quality of the ground water. There may be several existing wells (outside of SSID) which may be used for monitoring purposes or alternatively small diameter wells could be installed solely for the purpose of monitoring.

Water System Upgrades

The SSID water system is a well maintained and operated water system. A new well pump was installed three years ago and the water storage tanks were recently coated. The system is equipped with flowmeters and dual check valves for back flow protection at each service connection in the distribution system. At the well head, a turbine flow meter with 4-20 mA output and a totalizer is installed for online recording of the pumping rate and consequent correlation with water usage data.

The well pump is powered by an 18kW generator that runs on diesel fuel and is located in a separate generator kiosk behind the well pump house. The diesel fuel tank is located in the generator kiosk and is filled via a fill nozzle of the outside of the kiosk. A tray located under the fuel fill nozzle would collect any spillage when filling the tank. There is spill containment provided for the diesel fuel tank inside within the generator kiosk. The SSID should consider adding a fuel spill response section to their existing emergency response plan.

The well pump is controlled by pressure switches that were noted to be working correctly at the time of the site investigation. Subsequent information has indicated problems occurring with the pressure switches and controls for operating the well pump. This system currently uses the water distribution system pressure to provide an indication of the reservoir level and is not a direct measurement of the water level in the existing storage tanks. The SSID should consider installation of direct level measurement of the reservoir levels and have these signals transmitted down to the well control building. Instead of a hard wire connection, it may be more practical and cost effective to use a radio signal link to transmit information from the reservoirs to the well control building.

There is no backup generator or secondary well, which makes the system vulnerable to a water shortage in situations where equipment cannot be repaired or replaced as quickly as the stored water is depleted. For reliability of water supply, a second well should be drilled as a back-up well. Since this well would be intended as a back-up and would not operate at the same time as the current primary well, the existing generator is of sufficient capacity. The backup well and pump should draw from the Main Aquifer as it is the least likely local water source to experience microbiological contamination. The backup well should be located and pump tested with the assistance of a hydrogeologist. Based on a well depth of approximately 30 meters (100 ft), KWL's Electrical Engineer advises that the maximum distance a new well can be located from the existing generator would be approximately 250 meters with a No.2 wire size or approximately 150 meters with a No.4 wire size.

The lower distribution system in the SSID operates with low pressure, particularly during high use periods in July and August. The lack of pressure has caused expressions of concern from many users. The low pressure issue can be checked by ensuring all air release valves in the distribution system are working correctly. A water distribution model can be developed and water demands can be used to determine if increasing from a 100 mm distribution main to a 150 mm or 200 mm distribution main will alleviate the lower pressure issue.

The 75 mm supply main from the well to the reservoirs and the 100 mm and 150 mm distribution mains are generally of PVC pipe material. According to most pipe suppliers, PVC pipe typically is claimed to have a life expectancy of approximately 75 to 100 years. However this is based upon claims from manufacturers without the benefit of an installed track record of that duration.

Water Conservation

Water conservation incentives can be educational, financial or regulatory. Educational incentives such as bill-inserts, public events, newsletters and workshops may only exert short-term influence and can be easily forgotten by the customers. Education should therefore be implemented over a long time period and is most effective when coupled with other tangible incentives like hardware and technology programs.

Hardware and technology measures include low-volume toilets, showerheads and faucets, efficient washing machines, dishwashers, leak repair and water audits. These measures can be very effective at conserving water because they usually only need to be installed only and do not require ongoing efforts to maintain efficient water use. In contrast, training people to change their household and yard irrigation practices can result in water savings, but typically requires ongoing public-relations efforts.

Financial and regulatory incentives can be effective water conservation strategies because they often involve adverse consequences if they are not heeded. For example, excessive-sprinkling bylaws can be strong inducements to reduce outdoor water waste. Similarly, metering and volume-based pricing, when properly designed, has the potential to reduce overall water usage.

The SSID currently implements a financial water conservation incentive. The customers pay a flat rate for water services every quarter and any water users that exceed the quarterly water use limit of 25 cubic meters is charged at one dollar per cubic meter. All water connections in the SSID are metered allowing for manual meter reading once a month. In order to implement more aggressive water conservation practices, SSID could implement an increasing block rate where residents are charged an increasing cost for the water consumed above the allotted 25 cubic meters. According to the *AWWA Principles of Water Rates, Fees, and Charges (M1),* the increasing block rate structure is the most conservation-oriented rate structure and when properly designed can send an appropriate conservation signal to certain classes of customers. However increasing block rates can be difficult to design for predicting consistent revenue and the rate structure can be difficult to communicate to customers.

Recommendations

Implementation of the following recommendations would improve the system:

1. Source water protection strategies should include educating residents of possible contamination. The three unconfined aquifers eventually recharge the main aquifer so any microbiological contamination on the island should be avoided. Similarly, possible sources of chemical contamination on the island (i.e. gasoline) should also be properly maintained to ensure groundwater protection.

2. If additional capacity for SSID is to be taken from one of the three unconfined aquifers on the island, the high risk of microbiological contamination means this water would have to be treated by disinfection and possibly additional treatment before being distributed to residents. The need for treatment would be greatly reduced if the Main Aquifer was used for additional capacity.

3. Although previous reporting by others states that the Main Aquifer could handle much higher pumping rates of groundwater from SSID (100% increase or more), an updated and thorough wellhead study including a hydrogeological investigation of the Main Aquifer will provide the community with more certainty in regards to the maximum amount of water that can be drawn from the aquifer without resulting in sea water intrusion. A wellhead study should be conducted by a groundwater hydrogeologist.

4. A containment tray located under the fuel fill nozzle should be installed to collect any spillage outside the generator kiosk when filling the fuel tank and the emergency response plan for the water system should include a section dealing with potential fuel spills when re-fuelling the generator for the well.

5. The SSID should consider installation of direct level measurement of the reservoir levels and have these signals transmitted down to the well control building. Instead of a hard wire connection, it may be more practical and cost effective to use a radio signal link to transmit information from the reservoirs to the well control building. For better serviceability, the radio signal equipment and set-up of the links can be arranged through a local radio control supplier.

6. To support future investigations, include the installation of a rain gauge, and water level monitoring of several wells on the island. Water level transducers can be set up to log the level and the data recorded will usually insert a date and time stamp for each data entry. Consequently, regular water level monitoring would provide correlative data between aquifer water level, the tides, and pumping rate. Some of the monitoring should be from non-operational wells (observation wells).

7. Installation of a backup pump and/or generator would increase the reliability of the system and allow it to continue producing water should there be an equipment failure that lasts longer than the time it takes to deplete the reservoirs. The backup well should be located and pump tested with the assistance of a hydrogeologist and installed by a registered well pump installer.

We trust this document will help you in planning for the future of the SSID water system. If you have any questions, please contact either of the undersigned.

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STATEMENT OF LIMITATIONS